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Anatomical-radiological study of the plantar fascia and its correlation with Achilles tendon pathologies

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Although the plantar fascia (PF) has been studied quite well from a biomechanical viewpoint [1], nothing is known about its content of elastic fibers, the features of the extracellular matrix or the extent of innervation. From a functional and clinical standpoint, the PF is often correlated with the triceps surae muscle, but the anatomical grounds for this link are not clear.

Twelve feet from frozen human cadavers were dissected to isolate the PF. Specimens from each PF were tested with various histological and immunohistochemical stains. 52 MRI obtained in patients complaining of non-specific ankle or foot pain were analyzed. The thickness of PF and paratenon was assessed and statistical analyses were conducted.

The PF is a tissue firmly joined to plantar muscles and is closely connected to the paratenon of Achilles tendon through the periosteum of the heel. The PF was rich in hyaluronan, probably produced by fibroblastic-like cells described as "fasciacytes" [2]. Nerve endings and Pacini and Ruffini corpuscles were present, particularly in the medial and lateral portions, and on the surface of the muscles, suggesting a role for the PF in the proprioception of foot. In the radiological study, 27 of the 52 MRI showed signs of Achilles tendon inflammation and/or degeneration, and the PF was 3.43 ± 0.48 mm thick, as opposed to 2.09 ± 0.24 mm in the cases in which the MRI revealed no Achilles tendon diseases ($p<0.001$). In the group of 27/52 cases with tendinopathies, the PF was more than 4.5 mm thick in 5, i.e. they exceeded the threshold for a diagnosis of plantar fasciitis. None of the other 25/52 cases had a PF more than 4 mm thick. There was a statistically significant correlation between the thicknesses of the PF and the paratenon.

These findings suggests that the plantar fascia has a role not only in supporting the longitudinal arch of the foot, but also in its proprioception and peripheral motor coordination. Its relationship with the paratenon of the Achilles tendon is consistent with the idea of triceps surae structures being involved in the PF pathology, so their rehabilitation can be considered appropriate. Finally, the high concentration of hyaluronan in the PF points to the feasibility of using hyaluronan injections in the fascia to treat plantar fasciitis.

References

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Key words
Plantar fascia, Achilles tendon, hyaluronan, fasciitis.